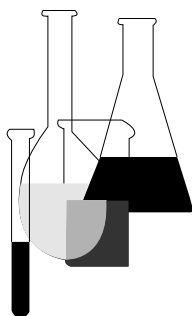




Occupational and Residential Exposure Test Guidelines

OPPTS 875.2500 Inhalation Exposure



INTRODUCTION

This guideline is one of a series of test guidelines that have been developed by the Office of Prevention, Pesticides and Toxic Substances, United States Environmental Protection Agency for use in the testing of pesticides and toxic substances, and the development of test data that must be submitted to the Agency for review under Federal regulations.

The Office of Prevention, Pesticides and Toxic Substances (OPPTS) has developed this guideline through a process of harmonization that blended the testing guidance and requirements that existed in the Office of Pollution Prevention and Toxics (OPPT) and appeared in Title 40, Chapter I, Subchapter R of the Code of Federal Regulations (CFR), the Office of Pesticide Programs (OPP) which appeared in publications of the National Technical Information Service (NTIS) and the guidelines published by the Organization for Economic Cooperation and Development (OECD).

The purpose of harmonizing these guidelines into a single set of OPPTS guidelines is to minimize variations among the testing procedures that must be performed to meet the data requirements of the U. S. Environmental Protection Agency under the Toxic Substances Control Act (15 U.S.C. 2601) and the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136, *et seq.*).

This guideline, along with the others in Series 875.2000 through 875.2900, is being substantially revised for publication in 1997. However, the current guidelines are still official. Before initiating any studies for post-application exposure registrants should contact EPA's Occupational and Residential Exposure Branch (within the Office of Pesticide Programs) at 703-305-6094.

Final Guideline Release: This guideline is available from the U.S. Government Printing Office, Washington, DC 20402 on *The Federal Bulletin Board*. By modem dial 202-512-1387, telnet and ftp: fedbbs.access.gpo.gov (IP 162.140.64.19), internet: <http://fedbbs.access.gpo.gov>, or call 202-512-0132 for disks or paper copies. This guideline is also available electronically in ASCII and PDF (portable document format) from the EPA Public Access Gopher (gopher.epa.gov) under the heading "Environmental Test Methods and Guidelines."

OPPTS 875.2500 Inhalation exposure.

(a) **Scope—(1) Applicability.** This guideline is intended to meet testing requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136, *et seq.*).

(2) **Background.** The source material used in developing this harmonized OPPTS test guideline is OPP guideline 133–4. This guideline should be used with OPPTS 875.2000 and 875.2900.

(b) **Purpose.** Data on inhalation exposure to airborne residues of a pesticide are required by 40 CFR 158.390 to estimate the amount of respiratory exposure during performance of an activity at a site. The data will then be used for the calculation of reentry levels and reentry intervals as described in OPPTS 875.2900.

(c) **Requirements for exposure data.** (1) The purpose of this paragraph is to delineate the requirements for developing and submitting data relating to human exposure for purposes of supporting reentry intervals proposed according to OPPTS 875.2900. The registration applicant should understand that useful exposure studies using surrogate chemicals—often other pesticides—may already exist and may be cited to meet the requirements of 40 CFR 158.390. Actual conduct of the study may be unnecessary if these data are cited. Therefore, the applicant should consult with the Agency before undertaking such studies. The submission and use of extant human exposure data on a surrogate pesticide is encouraged by the Agency and is acceptable if the registrant submits descriptions demonstrating that the sites and human activities for which the surrogate exposure data were obtained produce exposure which is greater than or substantially similar to those for which the reentry interval is being proposed.

(2) A registration applicant should not undertake or authorize development of information to meet the requirements of this guideline in such a manner as to pose a hazard to people assigned to perform activities in the study. The Guidelines for Protection of Human Subjects (45 CFR part 46) promulgated by the U.S. Department of Health and Human Services contains information that should be considered for design of such studies. Before conducting any such studies, registration applicants should submit study protocols for approval by the appropriate institutional review board or public health department in states where the studies are to be performed.

(3) Any studies or monitoring conducted pursuant to this guideline must not violate FIFRA section 12(a)(2)(P) which provides that:

...it shall be unlawful for any person in any State to use any pesticide in tests on human beings unless such human beings (i) are fully informed of the nature and purpose of the test ..., and (ii) freely volunteer to participate in the test.

(d) **General test standards.** (1) The applicant should obtain data from one or more studies regarding the quantity of pesticide residues that would be expected:

(i) To be deposited on the skin and clothing of a person undertaking the maximum exposure activity upon reentry.

(ii) To be inhaled by a person undertaking the maximum exposure activity upon reentry.

(iii) To result in a dose to a person by any combined route of intake that would be appropriate for the maximum exposure activity upon reentry.

(2) Different sites may result in very similar exposures to people engaged in the same general tasks (e.g., lettuce and cabbage harvesting). If data on other pesticides indicate that this is the case, data for one site may be used to estimate exposure at another site. A detailed explanation of any extrapolation processes used, such as from published studies to the study undertaken or from studies on exposure in one crop to their use on another crop, should be reported.

(e) **Reporting requirements.** The applicant should submit a complete description of the results of the exposure study, including all supporting data, extrapolations, estimates, and other relevant information. Such a description should include, but not be limited to:

(1) A complete description of the selected task (or tasks) used in the exposure study.

(2) A complete description of the end-use product used for the study.

(3) A complete description of the statistical approaches and treatment of data for the study.

(f) **Reporting of test results.** Data should be compiled for each exposure sample. These data sets should be indexed so that the exposure data can be related to the residue levels. The types of exposure data required may vary with the activity being studied. An example of the types of data needed in particular exposure situations are presented below as a guide:

(1) **Exposure data.** The following data, as appropriate to the use type, should be reported:

(i) Test substance and formulation.

(ii) Description of test site, including crop, plot size, row spacing, and height of crop.

(iii) Selected maximum exposure activity.

(iv) Investigator's name.

(v) Application rate.

(vi) Weather data, including relative humidity, wind conditions (steady or gusty), speed and direction of wind, sun condition (clear, partly cloudy, or overcast) and temperature.

(vii) Height of sample unit intake.

(viii) Number of samples collected.

(ix) Length of exposure.

(x) Beginning and ending airflow rates.

(xi) Any special situation observed that might alter normal exposure.

(2) **Analysis.** Laboratory operations should be recorded on a sample history sheet which includes:

(i) Storage methods and conditions for media and extracts.

(ii) The extraction and analytical procedures used.

(iii) For each sample, the sample number and dates of collection, extraction, and analysis.

(3) **Evaluation.** (i) Estimates of inhalation exposure should be reported for each individual sampling unit and for the group of sampling units as a whole.

(ii) The mean and the standard deviation of the exposures found for the group should be reported.

(iii) For calculations, exposure below the limit of detection for the analytical method should be counted as 50 percent of that limit.

(iv) The number of sampling units in the study and all assumptions used in the calculations should be reported.

(g) **Combined testing.** (1) Measurement of inhalation exposure should be combined with measurement of dermal exposure, as described in OPPTS 875.2400, when both types of data are required. The applicant should be certain that the standards for both types of testing are met in the combined study.

(2) Measurement of inhalation exposure to a pesticide during reentry into leafy crops should be combined with measurement of dislodgeable foliar residues. Measurement of inhalation exposure may be combined with tests discussed in OPPTS Series 810, Series 850—Group D, Series 835, and Series 860.

(h) **Test standards.** In addition to meeting the general test standards contained in OPPTS 875.2400, paragraph (d), an inhalation exposure study should also meet the following standards:

(1) **Test substance.** The applicant should use a typical end-use product for this data requirement.

(2) **Preparations for tests.** The specific sampling method, sampling medium, and analytical procedure to be used will depend on the material being studied, and are left to the discretion of the investigator. Inhalation exposure studies require procedures for the trapping, extraction, cleanup, separation, and quantification of pesticides. Methods of those types and associated information can be found under paragraphs (i)(1) and (i)(2) of this guideline. References under paragraphs (i)(3), (i)(4), and (i)(5) of this guideline may be useful for the design and interpretation of inhalation exposure studies. Any methods used must meet the standards prescribed in this paragraph.

(i) **Sampling media.** The specific sampling medium or media to be used will depend on the compound to be sampled. Polyurethane foam or a granular solid sorbent are generally recommended for vapors. Pore sizes and mesh sizes should be selected to permit appropriate airflow rates. Sorbents should be preextracted until the extract contains no material which will interfere with subsequent analysis. The sorbents should then be dried and placed in collection modules. If the sorbent does not adequately trap dust, dusts should be collected with glass fiber or PVC membrane filters placed in the collection module to follow the sorbent in the air stream.

(ii) **Sampling unit.** Whenever possible, battery-powered personal air samplers should be used. If the expected pesticide levels are below the limits of detectability by such low-volume air samplers, then stationary high-volume air samplers should be used instead.

(iii) **Sampling efficiency—(A) Sampling efficiency of low volume air-sampling pumps.** The sampling efficiency of the sampling unit and media should be demonstrated for the residues of interest and reported data should be adjusted accordingly.

(B) **Sampling efficiency of high-volume air-sampling pumps.** Both the retention and collection efficiencies for the combination of sampler and sorbent should be determined with the residue of interest. Whenever possible, tests should be performed outdoors with unaltered ambient air; if necessary, intake air should be filtered to remove interfering contaminants. At least one blank determination with unfortified filters should be made simultaneously to correct for airborne interferences, contamination, or losses through the analytical methodology.

(C) **Standards for air-sampling collection efficiency.** At least five determinations should be made for each test and the mean and standard deviation for recovery of the original material determined. The mean recovery should be at least 75 percent.

(iv) **Extraction method.** The extraction efficiency of the method chosen to extract residues from the sorbents should be determined or cited. Sorbent traps should be charged with the same material and formulation to be studied and at approximately the level expected to be collected during a sampling period in the field study. At least five replicate samples should be extracted and the mean and standard deviation for recovery determined. The mean recovery should be at least 75 percent of the original material.

(v) **Analytical procedure.** A study should be conducted or cited to demonstrate that the analytical method chosen, coupled with the sorbent and extraction method to be used, is capable of quantitative detection of 0.5 $\mu\text{g}/\text{m}^3$ or less of the compound being studied, or of human exposure to 1 $\mu\text{g}/\text{h}$ or less of the compound when possible. For applications involving material of very high toxic hazard, a greater sensitivity may be required.

(vi) **Stability of samples and extracts—(A) Stability of exposed media.** If sampling media are to be stored for longer than 24 h after exposure, a test of stability of the residues of interest while sorbed to the media should be conducted or cited. Media should be charged with pesticide by the same procedure used in paragraph (d)(3)(iii) of this guideline for sampling efficiency testing. Lots of five replicate samples should be stored for at least three different periods of time under the storage conditions for field samples. The samples should be extracted and analyzed by the methods to be used in field studies. The storage times should be chosen so that the longest corresponds to the longest projected storage period for the field samples and so that a decay curve can be constructed to allow extrapolation of residue levels back to the time of collection. Storage of field samples should not exceed periods that would result in loss of 50 percent or more of the original residue.

(B) **Stability of extracts.** If extracts from field samples are to be stored for longer than 24 h before analysis, a study should be conducted or cited that demonstrates stability of the compound of interest in the solvent to be used. Storage times should be chosen so that the longest corresponds to the longest projected storage period for extracts from field samples and so that a decay curve can be constructed to allow extrapolation of residue levels back to the time of extraction. Storage of extracts from field samples should not exceed periods that would result in loss of 50 percent or more of the residue originally extracted.

(vii) **Calibration of air-sampling equipment.** Sampling pump air-flow instruments should be calibrated for the particular sampling medium to be used.

(3) **Conduct of tests**—(i) **Positioning of sampling units.** If personal air samplers are used, the air intakes should be positioned to be at the height of the human breathing zone and should be oriented downward or horizontally to avoid collection of nonrespirable particles or droplets. If stationary samplers are used, the air sampling inlet should be positioned at the height of the breathing zone of an average-sized person engaged in the designated task. Airflow through the sampling unit should be measured at the beginning and end of each exposure period. If airflow changes during the exposure period, the mean of these two measurements should be used as the airflow rate for calculations of air volume sampled.

(ii) **Handling of samples.** Special care should be taken to avoid contamination of the samples in the field. To avoid further possible contamination, samples should be transported to the laboratory in sealed containers. The containers should be chilled or frozen to minimize residue losses in transit and storage.

(iii) **Typical activities.** The investigator should insure that all activities contributing to the exposure being studied are carried out in a manner consistent with typical use patterns of the end-use product.

(iv) **Application of the test substance**—(A) **Application rates.** Applications should be made at the maximum rate proposed on pesticide labeling for the application method and site.

(B) **Application method.** The application method that causes maximum residue levels should be used.

(v) **Duration of exposure.** The exposure period should be long enough for measurable residues to be collected. Air should be sampled throughout the period during which a person is expected to be exposed to the pesticide in the selected maximum exposure activity.

(i) **References.** The following references should be consulted for additional background material on this test guideline.

(1) Adams, J.D. and J.H. Caro. Polyurethane foam as trapping agent for airborne pesticides. EPA-600/4-80-008. Available from NTIS, Springfield, VA 22161. This report contains methodology for the evaluation of trapping media, for extraction of trapped residues from the media, for clean-up and separation of trapped residues by liquid chromatography, and for quantification by GLC. (1980).

(2) Lewis, R.G. Sampling and analysis of airborne pesticides. In: Air Pollution from Pesticides and Agricultural Process. R.E. Lee (ed.) CRC Press, Inc. Cleveland, Ohio. (1976).

(3) Davis, J.E. Minimizing occupational exposure to pesticides: Personnel monitoring. *Residue Reviews* 75:34–50 (1980). This review covers methodology for measurement of inhalation exposure, conduct of the studies, and conversion of airborne residue levels to total inhalation exposure.

(4) Kahn, E. Outline guide for performance of field studies to establish safe reentry intervals for organophosphate pesticides. *Residue Reviews* 70:27–44 (1979). This paper is primarily concerned with information for development of human-subject, field-study protocols to be conducted for establishment of reentry intervals for organophosphorus pesticides.

(5) Lewis, R.G. et al. Protocol for Assessment of Human Exposure to Airborne Pesticides. Report EPA–600/2–80–180 (1980). Available from the National Technical Information Service, Springfield, VA 22161. This report contains discussions of methods for the quantification of airborne residues in the worker environment and the conversion of airborne residue levels to inhalation exposure levels.